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LANL Shows Off Its Projects Buffalo Thunder hosts Research and Development Day

By Phil Parker
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The world will be safer when robots are loading our dishwashers.

Los Alamos National Laboratory scientist Steven Brumby is tackling such issues. With an assist from LANL's Roadrunner Supercomputer — one of the world's fastest — Brumby and the lab's Applied Machine Learning team are modeling the brain's visual cortex in hopes that a robot's future programming might analyze visual images like animals or vehicles and discern which is which.

"It's next-generation robotics," Brumby said. "Humans do something like the dishes easily, but a robot can't."

Yet.

Brumby was manning one of 45 presentations Wednesday at LANL's Laboratory Directed Research and Development (LDRD) Day at Buffalo Thunder Resort and Casino in Pojoaque.

Research and development, according to program director William Priedhorsky, is the driver for economic progress: It's the reason life expectancy has increased by almost 30 years over the last century; it's why diseases get cured and men have walked on the moon. We can plot the history of the universe back more than 13 billion years because of R&D, Priedhorsky said, and it is the force behind a nonproliferation movement that has, so far, prevented a nuclear bomb from wreaking mass casualties since the end of World War II.

It's not all about nonproliferation and dish washing, though. The vision sensors could be used, for example, to map national forests and identify their real-time needs. They could also improve auto safety: "Imagine if your car really

can see what's behind you," Brumby said.

Scientific advancement requires precision unheard of a generation ago, said Alan Bishop, associate director for Theory, Simulation and Computation at LANL. Scientists can use the latest supercomputers to look inside DNA strands, radically increasing what we understand about health and aging, for example.

Priedhorsky noted that research and development requires an understanding of materials at a ludicrously small scale, but it also incorporates larger levels. For example, to cure the flu virus, a scientist would need to understand how the flu attacks our nervous system at a molecular level, so that's the small scale. For a full understanding of the problem, though, he would also need to analyze how someone on a plane could infect his fellow passengers by sneezing. That's large-scale.

"The world is so detailed when you look at it in these scales," Priedhorsky said.

He also mentioned that the temperature inside a nuclear bomb increases by millions of degrees in a fraction of a microsecond. To understand nuclear weapons, scientists have to understand in the tiniest possible terms how a reaction like that is possible. But they've also got to know how an actual bomb could be moved or stored, and under what conditions.

A core LANL mission is stockpile stewardship, said Charles McMillan, principal associate director for weapons programs. McMillan compared stewardship to maintaining an older car: Driving on a dirt road might cause his eight-year-old car's engine to rattle, but most of America's nuclear weapons are more than 20 years old, and rattling is not an option.

At another LDRD booth on Wednesday, Reiner Riedel explained how he and his colleagues are working to map energetic particle movement in the space around earth. Our planet captures particles from the sun, he said, and they get "kicked around" both within our atmosphere and outside it. The result is, in space, something like weather — particles jostling about in ways expensive satellites don't like.

There are, according to the lab, 6,000 satellites orbiting earth. It only takes a small jolt to knock one out. "If your TV goes out, no big deal," Riedel said. "But

if our military is in the field somewhere and they need to communicate, it's a very big deal."

By studying the space environment around satellites, he said, the lab is working to address practical, modern issues. Yet the perimeter of his study area is about 70,000 kilometers away, said Riedel, "It's a huge laboratory."

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